

WATERPROOF AND BREATHABLE SOLE FOR SHOES, AND SHOE
MANUFACTURED WITH SUCH SOLE

Technical Field

The present invention relates to an improved waterproof and breathable
5 sole for shoes and to the shoe manufactured with such sole.

Background Art

Waterproof and breathable soles made of plastics for shoes are already
known.

One of such soles is disclosed in WO 97/14326.

10 In this case, the sole comprises:

-- a mid-sole with a membrane made of a material that is impermeable to
water and permeable to water vapor, associated with a lower protective layer
of a material that is resistant to hydrolysis, water-repellent, breathable and/or
perforated;

15 -- a tread made of perforated elastomer, which is joined perimetrically and
hermetically to the mid-sole.

The waterproof and breathable sole disclosed in WO 98/51177 is also
known; it comprises a preassembled insert in which there is a membrane that
is impermeable to water and permeable to water vapor, associated with a
20 lower protective layer made of a material that is resistant to hydrolysis,
water-repellent, breathable and/or perforated.

The insert is completed by an element that is overmolded or over-
assembled, surrounds the membrane and the protective layer, and is joined
hermetically to them.

25 The insert is part of a mid-sole and is joined, together with said mid-sole,
to a tread made of perforated plastic material, which is overmolded or over-
assembled.

In both cases, the protective layer arranged below the membrane is
designed to protect it against piercing due to foreign objects that have
30 accidentally passed through the holes.

The protective layer is usually made of felt and is coupled to the membrane in a breathable manner (by means of spots of thermoplastic adhesive, for example of the polyurethane-based type) to allow the passage of the vapor from the inside of the shoe toward the outside through the holes provided in the tread.

Breathable and waterproof soles for shoes are also known from USSN 09/978,634 and EPA No. 01124210.4 and comprise, at least along part of their extension, a lower waterproof component that constitutes the tread, an upper component with a supporting structure that is provided with holes connected to outlets at least on the upper and edge surfaces, and a waterproof vapor-permeable membrane that surrounds externally at least the outward-facing regions of the upper component.

The lower component, the upper component and the membrane are joined hermetically in the regions of possible internal water infiltration.

Although the above described soles have now been available commercially for years and are unanimously acknowledged as being capable of producing an exchange of heat and water vapor between the microclimate inside the shoe and the external microclimate, such soles, in some cases, such as for example use on the part of users with quantitatively higher-than-average foot perspiration, have been found to have a breathability that is insufficient to fully dispose of the generated vapor and ensure the correct microclimate inside the shoe.

The structure of the above described soles in fact has, at least in a downward region, layers of microperforated plastic material, i.e., provided with holes having a diameter on the order of 1-2 millimeters, and the total area of the microperforations in any case limits the area of the membrane that is actually affected by the exchange of heat and vapor.

Disclosure of the Invention

The aim of the present invention is to provide a waterproof and breathable sole for shoes, and the corresponding shoe, having an improved

structure that is capable of utilizing to the maximum extent the breathability of the membrane that is impermeable to water and permeable to water vapor.

Within this aim, an object of the invention is to provide a waterproof and breathable sole for shoes having a structure that allows to enlarge the area of the membrane until it affects substantially the entire sole of the foot.

Another object is to provide a sole that does not entail particular constructive complications with respect to conventional soles.

Another object is to provide a sole whose costs are competitive with respect to conventional types.

This aim and these and other objects that will become better apparent hereinafter are achieved by a waterproof and breathable sole for shoes having a structure that is characterized in that it comprises:

- a supporting layer which, at least in a preset macroportion, is made of net, felt or other diffusely perforated material;
- a membrane that is made of a material that is impermeable to water and permeable to water vapor and is associated above said supporting layer at least in said at least one preset macroportion made of net, felt or other diffusely perforated material, which it covers;
- a tread made of plastic material, with at least one through macroperforation at said at least one preset macroportion made of net, felt or other diffusely perforated material,

said tread being joined hermetically to said membrane and to said supporting layer at least at the perimeter of said at least one macroportion made of net, felt or other diffusely perforated material.

Brief description of the drawings

Further characteristics and advantages of the present invention will become better apparent from the detailed description of some embodiments thereof, illustrated by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a longitudinal sectional view of a waterproof and breathable

sole for shoes having the structure according to the invention, in a first embodiment;

Figure 2 is an enlarged-scale sectional view of a detail of the sole of Figure 1;

5 Figure 3 is an enlarged-scale sectional view of a detail of a variation of the sole of Figure 1;

Figure 4 is an exploded view of the components of the variation of Figure 3;

10 Figure 5 is a sectional view, taken along a longitudinal plane, of a waterproof and breathable sole for shoes having the structure according to the invention in a constructive variation;

Figure 6 is an exploded sectional view, taken along a longitudinal plane, of a waterproof and breathable sole for shoes having the structure according to the invention in a second embodiment thereof;

15 Figure 7 is a sectional view, taken along a longitudinal plane, of the sole of Figure 6 in the assembled condition;

Figure 8 is a bottom perspective view of a shoe provided with the sole of Figures 6 and 7;

Figure 9 is an enlarged-scale sectional view of a detail of Figure 7.

20 Ways of carrying out the Invention

With reference to Figures 1 to 4, a waterproof and breathable sole for shoes has, in a first embodiment, a structure that comprises a supporting layer 10 which is made of net, felt or other diffusely perforated material in preset macroportions 11.

25 The supporting layer 10 constitutes, in this case, the assembly insole of the shoe.

The term "macroportion" is used to reference portions of area preferably on the order of at least one square centimeter.

30 In the other portions 12, the supporting layer 10 can be constituted by a fine mesh of synthetic material, leather or other commonly used materials.

The structure also comprises a membrane 13, which is made of a material that is impermeable to water and permeable to water vapor (which is commonly commercially available and is made for example of expanded polytetrafluoroethylene), laminated onto a fine mesh 14 for supporting it, which lies above it, is made of synthetic material, and is arranged above the supporting layer 10 at at least the macroportions 11, which it covers.

The membrane 13 can be made of airtight material or of air-permeable material.

The membrane 13 can be coupled by means of spots of glue (not shown in the figures) to the supporting layer 10 in the regions of contact.

A tread 15 made of plastic material has through macroperforations 16 at the macroportions 11 and is joined hermetically to the membrane 13 and to the supporting layer 10 at least at the perimeters of the macroportions 11.

The through macroperforations 16 can be crossed by cross-members 16a, which prevent transverse deformations of the assembly by acting as tension members in the deformations that occur as a consequence of use.

The coupling (Figures 1 and 2) can be provided for example by means of a perimetric layer 17 of adhesive, which is spread so as to penetrate, when the components are joined, through the meshes of the net and join monolithically the tread 15 and the membrane 13.

As an alternative (Figures 3 and 4), it is possible to arrange between the supporting layer 10 and the membrane 13, or between the tread 15 and the supporting layer 10, a film 18 made of PVC or PU and then perform a high-frequency welding between the tread 15 and the membrane 13 by melting the film 18, with penetration thereof between the meshes of the net so as to join the components monolithically.

As a further alternative, it is possible to perform high-frequency welding of the layer 10 and the membrane 13 to the film 18 and then glue the assembly to the tread 15.

An inner sole, not shown in the figures, made of breathable or diffusely

perforated material, for supporting the foot, can be arranged above the supporting layer 10 and the membrane 13 with the fine mesh 14.

The described sole can be applied, in the commonly known ways, to an upper 20 of any kind so as to constitute a shoe 21.

5 With reference to Figure 5, in a slightly different embodiment it is possible to provide a single macroportion 11 that affects the entire sole of the foot without portions 12, regardless of the arrangement of the through macroperforations 16 of the tread 15.

10 In this case, the membrane 13 and its support 14 also affect the entire sole of the foot.

The glue 17 or the film 18 are arranged perimetrically.

With reference now to Figures 6 to 9, a waterproof and breathable sole for shoes according to a second embodiment has a structure that comprises a supporting layer 110 that is completely made of net, felt or other diffusely
15 perforated material, which accordingly constitutes a single large macroportion 111.

The sole again comprises a membrane 113 made of a material that is impermeable to water and permeable to water vapor (commonly commercially available and made for example of expanded
20 polytetrafluoroethylene), laminated together with a fine mesh 114 for supporting it which lies above it, is made of synthetic material and is arranged above the supporting layer 110, which it covers completely.

The membrane 113 can be made of airtight material or air-permeable material.

25 The membrane 113 is preferably coupled by means of spots of glue to the supporting layer 110.

It is possible to arrange a protective layer 110a, made for example of felt, below the membrane 113, for example if the supporting layer is made of net.

A tread 115 made of plastic material is assembled to the supporting layer
30 110 and is joined hermetically to the membrane 113 at least at the peripheral

region of said membrane.

The coupling can be provided by directly injecting the tread 115 onto the supporting layer 110 in a mold, with at least perimetric penetration through the meshes of the net or of the felt that is appropriately reduced in thickness at its perimeter, is perforated perimetrically or bordered with net so as to reach the membrane 113.

The tread 115 is provided so as to form macroperforations 116, for example a single large through macroperforation 116 that affects substantially all the sole of the foot, except for the perimeter 115a, which is interrupted by protrusions 115b that form, together with the perimeter 115a, the surface for contact with the ground.

The coupling between the tread 115 and the supporting layer 110 can be obtained also in the manners described in the first embodiment, i.e., by gluing or high-frequency welding.

The sole can be coupled to an upper 120, so as to provide a shoe 121 that is assembled on an assembly insole 124 and is optionally coupled in a downward region to a filler layer 122 made of an expanded material such as diffusely perforated EVA, coconut fibers, etcetera.

The layer 122, when it is made of diffusely perforated EVA or the like (therefore inherently waterproof but rendered air-permeable), can be used as a means for the perimetric hermetic high-frequency welding from above of the membrane 113 to the upper 120.

The subsequent gluing of the tread 115 need not necessarily be hermetic.

The coupling between the sole and the upper 120 is in the peripheral region of said assembly insole and is provided for example by gluing or high-frequency welding.

An inner sole 119 made of breathable or diffusely perforated material can be arranged above the assembly insole 124.

The inner sole 119 can also be coupled in a downward region to a shock-absorbing layer 119a made of polyethylene or the like, which is diffusely

perforated and anatomically contoured.

Other layers, not shown, such as cleaning insoles, absorbent layers et cetera, can be provided.

In practice it has been observed that the intended aim and objects of the present invention have been achieved.

A waterproof and breathable sole for shoes has in fact been provided whose structure is capable of utilizing to the fullest extent the breathability of the waterproof vapor-permeable membrane.

The structure allows to enlarge the area of the membrane until it affects substantially the entire sole of the foot.

The manufacture of the sole does not entail particular constructive complications with respect to conventional soles.

The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

All the details may further be replaced with other technically equivalent elements.

In practice, the materials, so long as they are compatible with the contingent use, as well as the dimensions, may be any according to requirements.

The disclosures in Italian Patent Application No. PD2002A000246 from which this application claims priority are incorporated herein by reference.